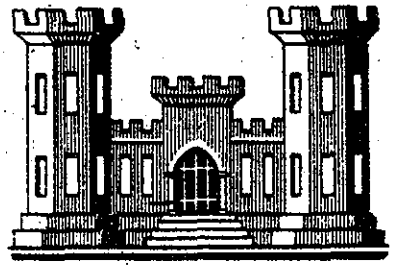
HURRICANE PROTECTION PROJECT

FOX POINT
HURRICANE BARRIER

PROVIDENCE RIVER, PROVIDENCE, RHODE ISLAND

DESIGN MEMORANDUM NO. 12
SEWER & UTILITY MODIFICATION



U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

JANUARY 1960

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO. NEDGW

29 January 1960

SUBJECT: Fox Point Hurricane Barrier, Providence, Rhode Island.
Design Memorandum No. 12 - Sewer and Utility Modifications.

TO: Chief of Engineers
Department of the Army
Washington, D. C.
Attention: ENGWE

In accordance with EM 1110-2-1150, there are submitted herewith for review and approval 10 copies of Design Memorandum No. 12, Sewer and Utility Modifications, Fox Point Hurricane Barrier, Providence, Rhode Island.

FOR THE DIVISION ENGINEER:

JOHN WM. LESLIE
Chief, Engineering Division

Incl
Design Memo No. 12
(10 cys)

FOX POINT HURRICANE BARRIER

PROVIDENCE
RHODE ISLAND

DESIGN MEMORANDUM NO. 12

SEWER & UTILITY MODIFICATION

Index to Design Memoranda

No.	Title	Submission Date	Approved
1	Geology	9 October 1959	6 November 1959
2	Hydrology Preliminary Final	 3 June 1959 7 November 1959	 8 June 1959 21 December 1959
4	Hurricane Tidal Hydraulics		
5	General Design Memorandum	22 December 1959	
6	Embankment & Foundations		
7	Structural Section I		
8	Structural Section II		
9	River Gates		
10	Pumping Station	22 January 1960	
10A	Foundation Pile Design		
11	Cooling Water Canal		
12	Sewer & Utility Modification		
13	Providence River Cooling Water and Corrosion Considerations	8 January 1960	
14	Concrete Aggregates	3 November 1959	27 November 1959

FOX POINT HURRICANE BARRIER

PROVIDENCE, RHODE ISLAND

DESIGN MEMORANDUM NO. 12

SEWER & UTILITY MODIFICATIONS

CONTENTS

LIST OF PLATES

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASSACHUSETTS

FOX POINT HURRICANE BARRIER

PROVIDENCE RIVER

RHODE ISLAND

DESIGN MEMORANDUM NO. 12

SEWER AND UTILITY MODIFICATIONS

JANUARY 1960

A. GENERAL

1. The purpose of this memorandum is to present the modifications of the existing sewer and utilities necessitated by the construction of the Fox Point Hurricane Barrier.

B. DESCRIPTION - EXISTING UTILITIES

1. Public.

a. Water. - The water distribution system is owned and regulated by the Providence Water Supply Board. Mains are cement lined cast iron pipe, class 250.

b. Combined Sewers. - (1) General - A 102-inch trunk sewer originating close to the Barrier combines flows from branches on both sides of the Providence River and conveys the sewage to a municipal treatment plant at Fields Point, about 3 miles away on the west bank of the Providence River.

(2) East Side Sewer. - The highland section of the city located east of the Providence River, known as the "East Side" is sewered by a combined system. Laterals connect with branch sewers on South Water and India Streets which in turn are connected to the trunk sewer in Allens Avenue through a 48-inch inverted siphon under the Providence River. The South Water Street branch is a 62-inch circular brick sewer. The India Street branch is a 50-inch circular brick sewer. The sewer connecting the siphon to the trunk sewer is a 78-inch circular brick sewer.

(3) Eddy St. Sewer. - The principal branch sewer serving the downtown section is a 74-inch circular brick sewer beginning at the intersection of Dorrance and Dyer Streets. The sewer is located in Dyer St., Eddy St. and Allens Ave. and combines with the 78-inch East Side sewer at the beginning of the 102-inch trunk sewer.

c. Storm Drains. - The storm drains involved by the construction of the Barrier include a 12-inch and a 20-inch drain in Allens Avenue, a projected 54-inch drain to be constructed in connection with a new section of the expressway and a 12-inch drain in South Main Street. The drains on Allens Avenue collect runoff from Crary Street to Henderson Street. The projected 54-inch drain has been relocated from the original layout to meet the conditions imposed by the Barrier. Construction of this drain by the State of Rhode Island is scheduled for 1960.

2. Private Utilities.

a. Narragansett Electric Company (See Plate 12-4 and Plate 12-5).

(1) Water. - The distribution system on the Electric Company property is used to supply the hydrants and the foam system.

(2) Foam. - The foam lines are for fire protection.

(3) Sewer. - A house connection from the Bidden Building may exist in the general location of the dike. The building will be razed and the sewer will be removed so that there will be no pipes remaining under the dike.

(4) Drain. - An abandoned drain line will be removed as indicated on Plate 12-5.

(5) Steam. - A 3-inch low pressure line covered by Ric-wil is used to heat the contents of the oil storage tank.

(6) Oil. - A 12-inch welded steel oil suction line is installed adjacent to the steam line.

(7) Air. - A 2-inch air line, adjacent to the steam and oil lines is used for purging the oil line after each use.

(8) Electric. - A 12-duct conduit in Allens Avenue is the main power supply for the southern section of Providence. In South Water Street there is a 12-duct conduit which is the main power supply for the "East Side" and a 4-duct conduit for the street lighting system. The new work must be performed without injury or interruption to the 12-duct conduits.

b. Providence Gas Company.

(1) Allens Avenue. - A 30-inch main supplies the greater portion of Providence south of the Barrier.

(2) South Main Street. - A 6-inch and a 20-inch main are involved in the work.

c. N.Y., N.H. & H. Railroad.

(1) Trackage in Allens Avenue is used quite extensively south of the Barrier. North of Henderson Street it serves three customers but only one is active and the trackage is used about one day a week.

C. PROPOSED RELOCATIONS

1. General. The existing utility systems have been studied to determine the effect of the Barrier upon them and to determine the measures necessary to protect them or to keep them in service without reducing the benefits afforded by the Barrier.

2. Combined Sewers:

(a) Eddy St. Sewer.

(1) Description: Three branch sewers discharge into the 74-inch sewer at Dorrance and Dyer Streets; a low level 70-inch sewer which is, in effect, a continuation of the 74-inch sewer, a high level 66-inch sewer in Dorrance St. and a 20-inch sewer in Dyer Street. The latter two are connected to the 74-inch sewer by means of "slots" which regulate the flow into the 74-inch sewer. In dry weather all flow passes through the slots. During periods of a storm runoff, flow in excess of the capacity of the slots is discharged to the river through the high level 66-inch sewer. Flap gates prevent reverse flows in the 66-inch sewer during periods of high river stages. Reverse flow from the 74-inch sewer through the slots is possible. Similar "slot" connections exist between the 74-inch sewer and the 40-inch x

60-inch sewer in Elm Street and the 34-inch x 51-inch sewer in Point Street. Several other small laterals connect to the 74-inch sewer. Most of the downtown buildings are connected to the 70 and 74-inch sewers rather than into the 66-inch high level sewer.

(2) Normal Operation. - The invert elevation of the 74-inch sewer in the manhole at the intersection of Dorrance and Dyer Streets is -8.27± MSL and the invert elevation at the junction chamber in Allens Avenue is -9.84 MSL. The average slope of the sewer in this reach is 6-inches per 1000 feet (S=.0005). The capacity of the sewer flowing full without surcharge is 78 cfs using an "n" value of 0.017. The pumping station at the treatment plant has a reported pumping capacity of 200 MGD or 310 cfs. The estimated capacity of the 78-inch sewer from the East Side is 90 cfs. It is very probable that the combined sewers do not flow under a surcharged condition except for extreme storm conditions. There are no gaging records to indicate the actual conditions which do exist.

(3) Storm Conditions: There are about 961 acres of downtown Providence tributary to the 74-inch sewer. Present practice is to manipulate the gates on the eight relief sewers as necessary to bypass flows in excess of the sewer capacity to the river. It is possible to divert all flows upstream from Eagle Street to the river if necessary. Pumps at the treatment plant continue to operate as required so that considerable relief is obtained even under conditions of high river stages. The City of Providence has adopted a policy of recommending property owners install backwater valves if they receive complaints about surcharge conditions in the sewers. Conditions of power failures and other emergency conditions have occurred in the past but the incidence of basement flooding due to surcharged sewers is minor.

(4) Effect of Barrier Operation: In the event of a hurricane requiring closure of the river and vehicular gates the sewer gates would probably be closed. However, the pumping station normally operates as long as possible and the sewer gate closure would be deferred as long as possible. The duration of closure would be relatively short but an overflow to the river is necessary.

(5) Overflow Bypass: Two sites for an overflow have been considered. The first location at Globe Street required construction across the Narragansett Electric Company property and an expensive crossing of the cooling water channel. A relief sewer at Ship Street is shorter, does not require crossing the cooling water channel and lowers

the maximum head at the beginning of the 74-inch sewer. This location was adopted.

(6) Pumping Station: A pumping station has been studied as an alternate means of reducing the surcharge in the sewer during hurricane periods. A site near Globe Street was selected on the premise that the sewer would continue to function in a normal manner during the emergency. Discharge would be through one or more force mains across the cooling water channel to the river. Preliminary studies were based on an installed pump capacity of 175 cfs. With tributary sanitary sewage flow estimated at 37 cfs the pumps could handle up to 138 cfs of storm water. Subsequent studies might have resulted in a smaller station but the great depth and even a minimum pump capacity would have made a substantial investment necessary. The surcharge which will exist in the sewers for a relatively short period of time and the infrequent occurrences coupled with the fact that basement flooding can be minimized or eliminated by backwater valves does not justify the expenditures for the initial cost and maintenance charges for a pumping station. This situation has been discussed with officials of the City of Providence and they have concurred fully in the decision.

(7) Construction Conditions: The State of Rhode Island has indicated that the disposal of raw sewage in the Providence River during construction of the sewer gates and new section of sewers in Allens Avenue and South Water Street would necessitate the discontinuance of shell fishing in a part of Narragansett Bay. Such action would be a serious blow to the shellfishing industry. To prevent such a condition, and to avoid costly pumping, temporary by-passes will be constructed around the new sewerage construction in Allens Avenue and South Water Street and the portion of the existing 78-inch sewer to be replaced by 72-inch pipe.

(8) Operation: During hurricane alerts, the river gates will be closed and the pool upstream of the new barrier will be maintained as nearly as practicable between elevations - 1.00 and +1.00 MSL; thus, under the worst hurricane conditions, this sewer would be discharging to a tailwater elevation of + 1.00 MSL.

Under normal operating conditions, and these conditions include abnormally high tides up to elevation +6.0 MSL, it is intended that the sluice gate in this relief line will be in a closed position. This is the same as is now being done with the present relief sewers, thus allowing the main sewer to function normally.

During hurricane alerts when the main sewers on Allens Avenue will be closed, all relief sewers discharging into the Providence River, including the new Ship Street line, will be ungated and in operation. This will

cause a surcharge in the main sewage system for a few hours. Since this situation has happened previously during hurricane flooding and a breakdown in the main pumping station, many of the buildings have had check valves installed to prevent the backup of sewage.

b. South Water Street Sewer.

(1) Description: The southern end of South Water Street closely parallels the Providence River in plan and profile. The sewer has a very flat gradient and has been provided with three relief sewers upstream from the barrier. There is a 26-inch x 39-inch brick sewer at Pike Street, a 29-inch circular brick sewer at College Street and a 28-inch x 42-inch brick sewer at Market Square.

(2) Normal Operation: Under normal conditions the sewage flows down South Water Street, combines with the sewage flows from India Street and then flows through the siphon to the west side sewers. Relief sewers are normally closed.

(3) Storm Conditions: Under storm conditions the gates on the relief sewers are manipulated as required to pass the combined flows. Flows in excess of the sewer capacity are bypassed to the Providence River. Flap gates prevent a reversal of flow into the sewer.

(4) Effect of the Barrier: The Barrier is being constructed across the South Water Street sewer upstream from its junction with the India Street sewer. Consequently it will be necessary to provide a gate and structure so the gate may be closed in the event of a hurricane. Storage space in this sewer is extremely limited and would be utilized very quickly. The existing relief sewers would help but it is considered necessary to provide an additional relief sewer.

(5) Overflow Bypass: A gated relief sewer will be constructed north of Tockwotten Street. A manhole with a wood tide gate similar to those now in use throughout the city sewer system will be installed to prevent reverse flow of river water when the tide is above elevation -2.0 MSL. This gate will normally remain in a closed position except during hurricanes when it is necessary to close the South Water Street sewer.

3. Storm Drains: -The only existing storm drains requiring modification to prevent the introduction of flood waters upstream of the proposed Barrier occur in the vicinity of Allens Avenue near the vehicular gate.

It is proposed to remove the existing 20-inch drain through the Barrier section and substitute two drains at both curb lines and allowing flow in a northerly direction to Crary Street where those lines will tie into the State of R. I. new 54-inch storm outfall.

The corrective measures proposed for the 12-inch storm drain will be accomplished by the State of R. I., Department of Public Works, when this line is constructed. A flap valve will be installed and a locked-type manhole frame and cover provided at the manhole immediately north of the Barrier on this line.

4. Gas: - The bypassing of existing gas mains in Allens Avenue and South Main Street is opposed by the Providence Gas Company. Officials of the company expressed the desire to maintain service during construction since the 30-inch high pressure main in Allens Avenue and the existing 20-inch main in South Main Street are main supply lines and interruption of service would pose a serious and costly problem. All gas mains therefore will be left in place and protected during construction.

5. Water: - All water lines, public and private, which occur in the vicinity of the dike can be relocated without serious complications concerning service to existing customers. For relocations see Plates 12-2, 12-3, 12-4, & 12-8.

6. Foam: - The foam lines located in the dike area in the Narragansett Electric Company yard can be relocated as shown without seriously affecting service. See Plate 12-2.

7. Steam, Oil and Air: - These lines, all owned by the Narragansett Electric Company, can be relocated without disruption of operations. Officials of the company have stated that during the interruption of these lines, similar services can be obtained from other existing oil tanks. It is proposed to relocate these utilities in a common trench. Interruption will be for that period required to make the connections only.

8. Electric: - a. General. - The 12-duct electrical conduits in Allens Avenue and South Water Street must remain in service without interruption. Officials of the Narragansett Electric Company stated it would be necessary to support the conduits through the dike section at South Water Street to avoid cable breaks since a considerable settlement of the foundation during construction is anticipated. Interruption of service of the 4-duct electrical conduit in South Water Street is acceptable to the utility company since this utility serves the street lighting system in a small portion of the East Side only. The relocation of direct burial cable in the Narragansett Electric Company Yard presents no problems by service interruption.

b. Treatment: - The conduit at Allens Avenue will be protected in place during construction and embedded in the base slab of the vehicular gate.

The 4-duct conduit at South Water Street will be relocated adjacent to the 12-duct conduit and both conduits will be supported on piling.

9. Railroad: - The railroad trackage at Allens Avenue serves three customers; the Ward Baking Company, the Narragansett Electric Company, and the unoccupied Franklin Processing Co. building. The trackage is for emergency use only by the Narragansett Electric Company. The Ward Baking Company, is the only user which would be affected by construction operations.

The Ward Baking Company now receives five cars of flour per week and have stated a preference for trucking of this flour during the construction period. The cost would amount to approximately $100 per car, and for a construction period of approximately 12 weeks, the trucking charges would be in the vicinity of $6000. The Ward Baking Company have also stated that its operations will be relocated within a short time. Based on this statement as well as the low cost of trucking charges, it is feasible to remove all trackage during construction operations and replace these tracks upon completion of the vehicular flood gate construction and necessary utility modifications. This assumption has not been presented to the railroad company for its approval, but will be discussed fully with the company before it is included in the construction specifications.

D. PROPOSED UTILITY MODIFICATIONS

1. Allens Avenue:- a. Existing Utilities in Allens Avenue which are involved in the construction of the Hurricane Barrier are the 74-inch, 78-inch and 102-inch trunk sewers; a 20-inch storm drain; a 30-inch high pressure gas main; a 12-duct electrical main feed; a 12-inch water main; 2 railroad tracks and an additional railroad spur track, and the possibility of an additional 24-inch gas main which the Providence Gas Company is contemplating installing in the near future.

b. Railroad: It is proposed that all trackage in Allens Avenue will be removed during construction operations and relaid upon completion of the work.

c. Combined Sewers: - The 102-inch sewer will be reconstructed through the barrier, using a reinforced concrete plastic lined section of equivalent area, supported on piling. A sewer gate chamber will be located downstream of the barrier to eliminate the condition of interior pressure during hurricane stages. Two 72" x 60" gates will be provided due to the restricted height of the structure below the pavement level. The gates will be operated electrically with the use of a submersible type motor attached to a gate stand and remotely controlled from a panel erected on the dry side of the west abutment wall of the proposed Allens Avenue Vehicular Gate. The hydraulic losses through this chamber are negligible due to the fact that this sewer flows half full during dry weather and seldom flows to full capacity.

d. Other Utilities: - Upon completion of the sewer installation and backfill to the bottom of the vehicular flood gate base slab, the 30-inch gas line and 12-duct electrical line will be exposed and supported during construction of the base slab. If the contemplated 24-inch gas main has been constructed it will be supported in a similar manner.

2. 78-inch Sewer: - The section of the 78-inch sewer under the dike will be replaced with a standard diameter 72-inch pipe (plastic lined) with short transition sections to the existing sewer. An electrically operated gate will be installed in a gate chamber on the bay side of the dike. The chamber will be protected from waves and debris by extension of the dike section around it. The pipe joints will have rubber gaskets.

3. Narragansett Electric Company Yard: - a. General. - The relocation of utilities in and adjacent to the Narragansett Electric Company yard involves relocation of existing 8-inch and 10-inch water lines, 2-inch foam line, 2-inch air line, 12-inch oil line and 3-inch steam line. The work will also require the relocation of existing electrical and telephone cables.

b. Oil Line: - The 12-inch oil line, the 2-inch air line and the 3-inch steam line (in Ricwil) must be relocated in such a manner as to be accessible in the future. They will be relocated around the dike and through the Narragansett Electric Company vehicular gate, at the west abutment, as shown on Plate No. 12-2.

c. Water: - Due to the extent of the possible settlement and the type of dike cutoff under the dike, the existing water lines and meter pits at Crary Street will be removed and salvaged with new water lines installed downstream of the dikes and supplied by an existing 12-inch water main in Allens Avenue. A new water pit will be constructed utilizing the existing water meters and valves which will supply the existing foamite house and fire main along the dock. The Providence Water Supply Board's water loop at Crary and Globe Streets will be relocated as shown upstream of the dike, as shown on Plate 12-2.

d. Electrical and Telephone: - Existing underground electrical and telephone lines located within the yard will be rerouted through the vehicular gate at the west abutment as indicated, as shown on Plate 12-2.

4. Expressway Storm Drain: - The 54-inch storm drain running from Crary Street to just north of the breaker house at the west abutment is a new storm drain which will be constructed by the State Department of Public Works as a drainage outfall for an expressway which will be under contract in 1960.

A paved ditch at the upstream toe of the dike will be provided for the collection of water resulting from waves overtopping the dike during extreme hurricane tidal conditions. This water will flow into a drop inlet located near the west abutment and then through a new 60-inch culvert to a new junction manhole into which the expressway storm drain will discharge and through the wall to the channel (see Plate No. 12-7).

5. Ship Street Overflow Sewer: - The Ship Street overflow sewer will consist of a 60-inch gated pipe. A sluice gate and chamber will be provided. The gate will be normally in a closed position except during hurricane floods, at which time the sluice gate will be in an open position when the sewer gates in the 102-inch and 78-inch sewers at Allens Avenue are in a closed position.

6. South Water Street: - a. General. - In South Water Street (See Plate Nos. 12-3, 12-8 and 12-9) there exists a 12-duct electrical main feed, a 4-duct electrical line, a 12-inch storm drain, a 62-inch brick sewer and a 12-inch water main.

b. Water: - Due to the possible settlement, the 12-inch water line will be relocated by laying a new line from the intersection of Tockwotton and South Water Streets to the intersection of Tockwotton and South Main Streets and thence tie into the India Street main opposite South Main Street.

c. Electrical: - The 4-duct and 12-duct electrical line will be supported on piles under the earth dike section. This will involve the reconstruction of a portion of the 4-duct electrical line in order to place the two duct lines side by side. These are to be placed on piles because of the anticipated settlement under the dike section which could cause serious damage to the lines. The possible void under the duct lines consequent to settlement of the adjacent foundation material will be cared for by seep fins and by provisions for grouting.

d. Sanitary Sewer: - The reconstructed sewer will be a 60-inch R. C. pipe, plastic lined. It will have a sluice gate structure with hand and motor operated gate stand downstream of the dike similar to that proposed at the 78-inch sewer at Allens Avenue. Due to the thickness of the organic silt considerable settlement is expected; therefore the sewer will be constructed on a

concrete cradle which will be supported on piling. Seep rings and provisions for grouting of voids under the sewer due to settlement will be provided.

e. Storm Drain: - The storm drain will be removed within the limits of the dike.

f. Overflow Sewer: - The new diversion and relief sewer will be located just north of the intersection of Tockwotton and S. Main Streets and will consist of a diversion manhole constructed over the existing 62-inch brick sewer and of approximately 100 feet of 60-inch plastic-lined concrete pipe from the diversion manhole to the Providence River. A manhole in this line will accomodate a wood tide gate to prevent backup of river water when the river water is above elevation -2.0 MSL.

7. South Main Street: - a. General. - The utilities in South Main Street are a 20-inch gas main, 6-inch gas main, 6-inch water main, 12-inch sanitary sewer, 4-duct electric line and the relocated 12-inch water line from South Water Street as shown on Plate Nos. 12-3 and 12-10.

b. Relocations: - The 12-inch sewer located within the construction limits will be abandoned and removed as it will serve no upstream building. The 6-inch and 20-inch gas mains will remain in place and will be incorporated in the gate footing. The 4-duct electric line will remain in place and will be incorporated in the gate footing. The 6-inch water line will be removed and replaced with the new 12-inch main loop from South Water Street which will be located in the footing.

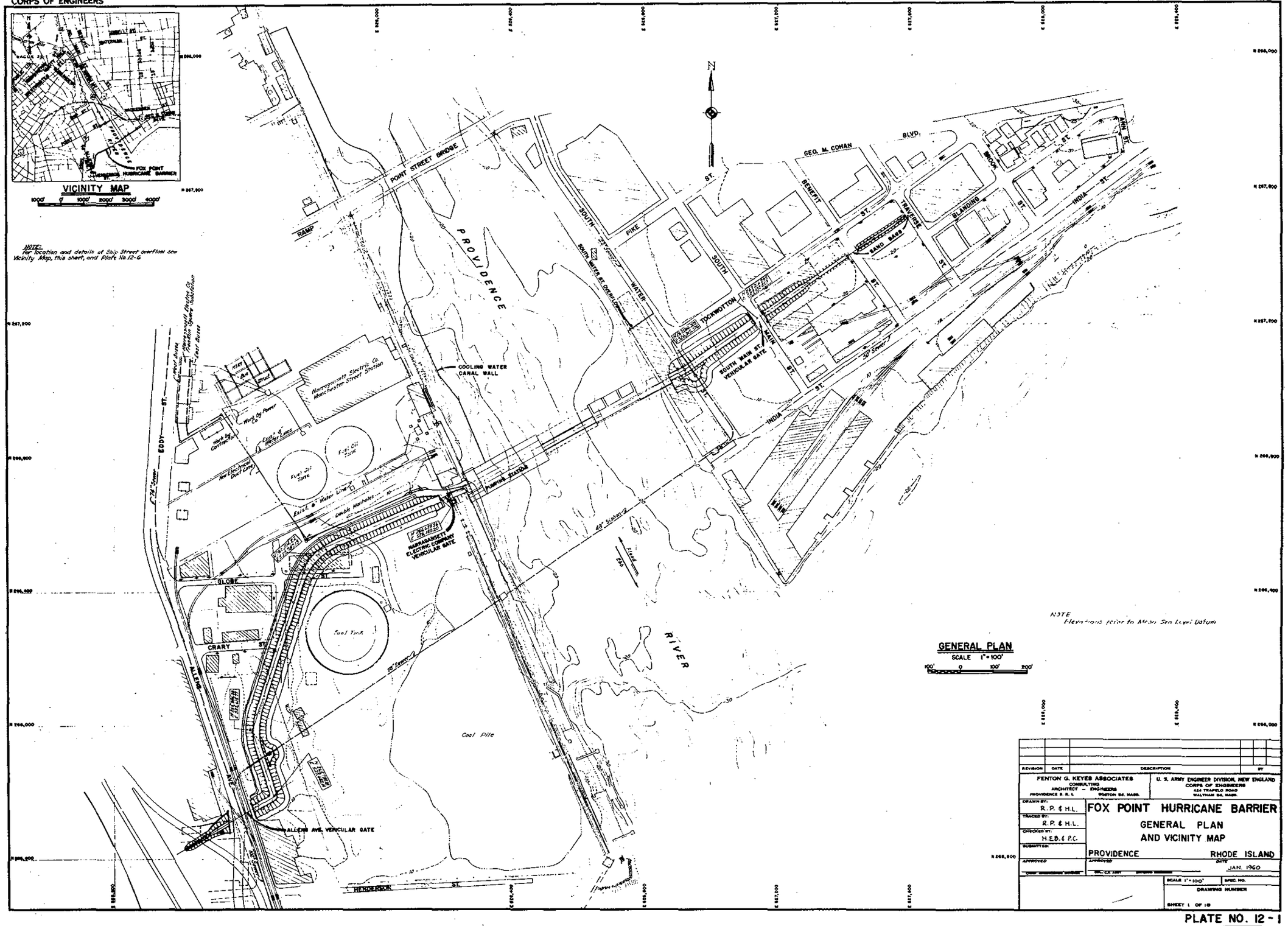
CORPS OF ENGINEERS

U. S. ARMY

VICINITY MAP

100' 0 1000' 2000' 3000' 4000'

NOTE:
For location and details of Ship Street overflow see Vicinity Map, this sheet, and Plate No. 12-6



NOTE
Elevations refer to Mean Sea Level Datum

GENERAL PLAN

SCALE 1"=100'

100' 0 100' 200'

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT – ENGINEERS
PROVIDENCE R. I. BOSTON 56, MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

DRAWN BY: R. P. & H. L.
TRACED BY: R. P. & H. L.
CHECKED BY: H.E.B. & P.C.
SUBMITTED:
APPROVED:

FOX POINT HURRICANE BARRIER

GENERAL PLAN AND VICINITY MAP

PROVIDENCE RHODE ISLAND

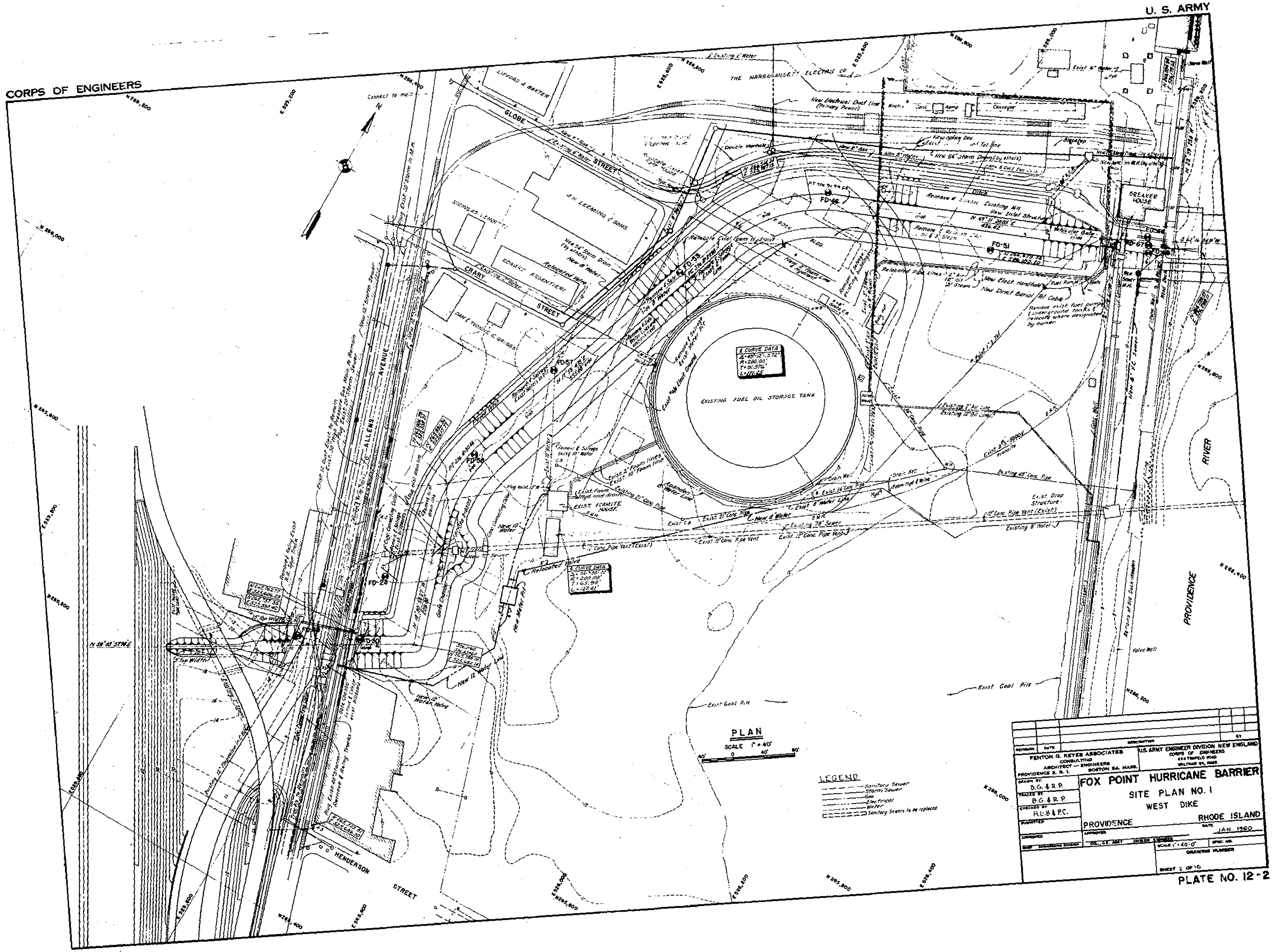
APPROVED DATE JAN. 1960

SCALE 1"=100' SPEC. NO.

DRAWING NUMBER

SHEET 1 OF 10

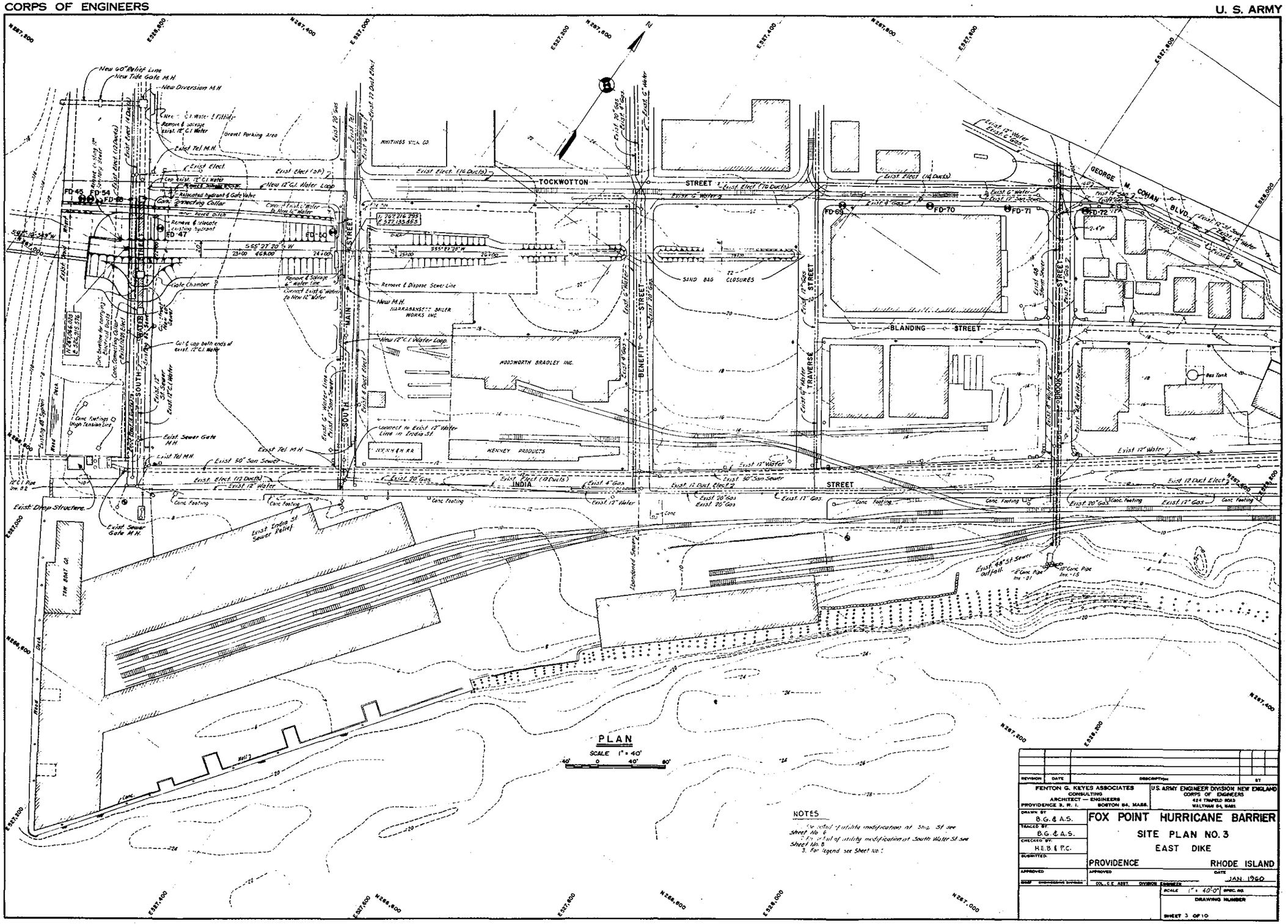
PLATE NO. 12-1



CORPS OF ENGINEERS
U. S. ARMY
GLOBE STREET
CRARY STREET
ALLENS AVENUE
HENDERSON STREET
THE NARRAGANSETT ELECTRIC CO.
A.H. LEEMING & SONS
LIFFORD & BAXTER
NICHOLAS LENDITTI
EDWARD ARGENTIERI
DAN & YVONNE E. GRIGGS
EXISTING FUEL OIL STORAGE TANK
BREAKER HOUSE
EXIST. FOAMITE HOUSE
PROVIDENCE RIVER
PLAN
SCALE 1" = 40'
LEGEND
Sanitary Sewer
Storm Sewer
Gas
Electrical
Water
Sanitary Sewers to be replaced
FENTON G. KEYES ASSOCIATES
CONSULTING
ARCHITECT — ENGINEERS
PROVIDENCE 3, R. I.
BOSTON 34, MASS.
U.S. ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.
FOX POINT HURRICANE BARRIER
SITE PLAN NO. 1
WEST DIKE
PROVIDENCE
RHODE ISLAND
DRAWN BY: B.G. & R.P.
TRACED BY: B.G. & R.P.
CHECKED BY: H.L.B. & P.C.
DATE JAN. 1960
SCALE 1" = 40'-0"
SHEET 2 OF 10
PLATE NO. 12-2

CORPS OF ENGINEERS

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT — ENGINEERS
PROVIDENCE 3, R. I. BOSTON 54, MASS.

U.S. ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS
424 TROYLO ROAD
WALTHAM 54, MASS.

DRAWN BY: B.G. & A.S.
TRACED BY: B.G. & A.S.
CHECKED BY: H.E.B. & P.C.
SUBMITTED:
APPROVED:

FOX POINT HURRICANE BARRIER

SITE PLAN NO. 3

EAST DIKE

PROVIDENCE RHODE ISLAND

APPROVED: DATE: JAN. 1960

COL., C.E. ASST. DIVISION ENGINEER

SCALE 1" = 40'-0" SPEC. NO.

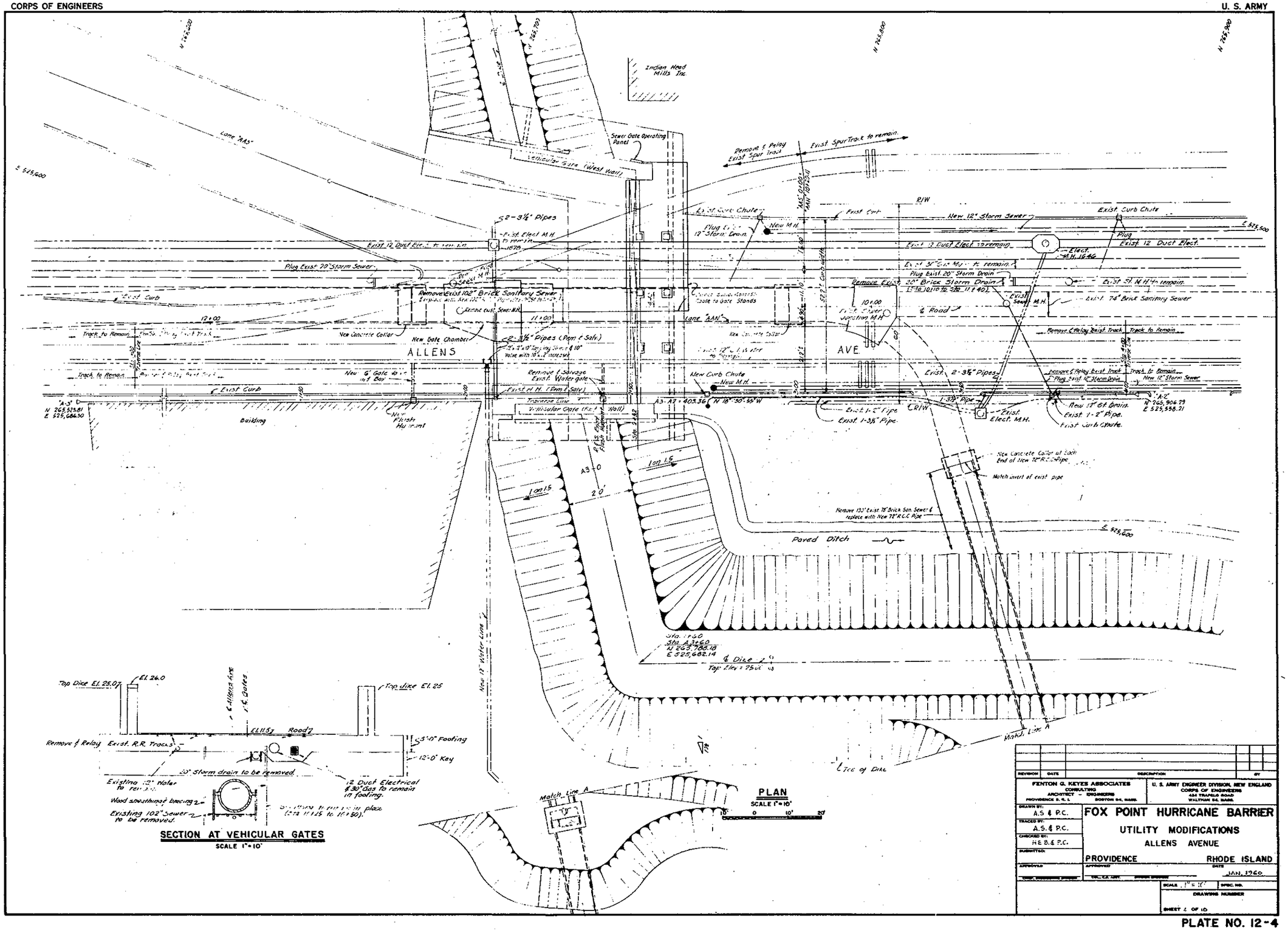
DRAWING NUMBER

SHEET 3 OF 10

PLATE NO. 12-3

CORPS OF ENGINEERS

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT - ENGINEERS
PROVIDENCE R. I. BOSTON MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

DRAWN BY: A.S & P.C.
TRACED BY: A.S. & P.C.
CHECKED BY: H.E.B. & P.C.
SUBMITTED:
APPROVED:

FOX POINT HURRICANE BARRIER

UTILITY MODIFICATIONS

ALLENS AVENUE

PROVIDENCE RHODE ISLAND

APPROVED: DATE: JAN. 1960.

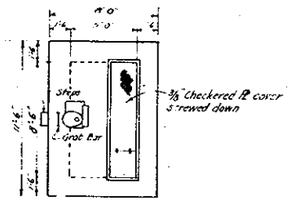
CHIEF, ENGINEERING DIVISION — CHIEF, C.E. ARMY — DIVISION ENGINEER

SCALE: 1" = 10' SPEC. NO.

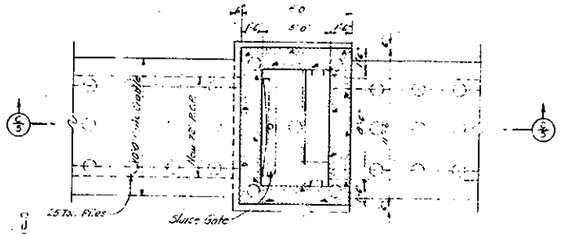
DRAWING NUMBER

SHEET 1 OF 10

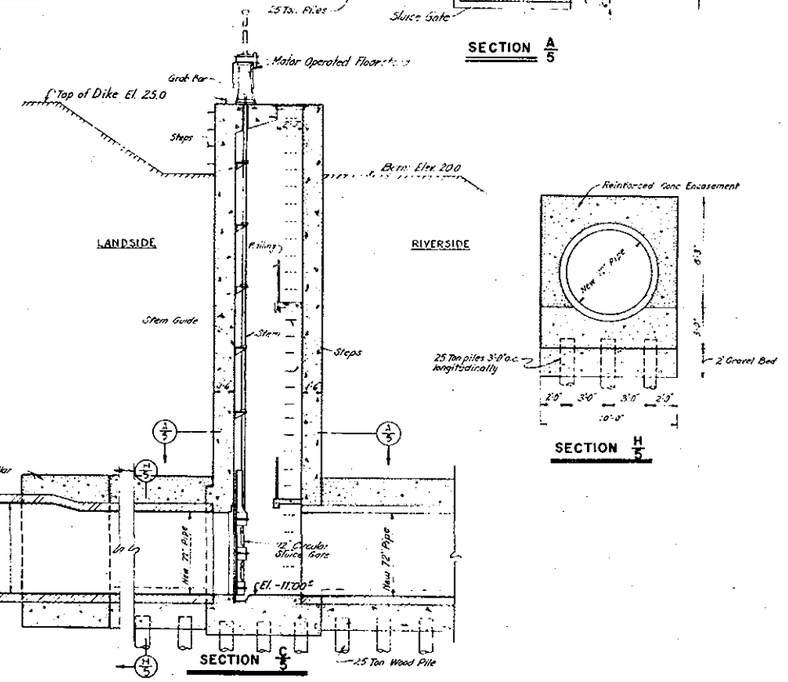
PLATE NO. 12-4



PLAN



SECTION A/5

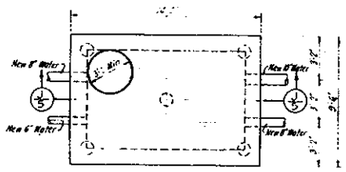


SECTION C/5

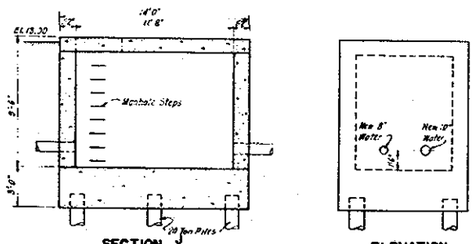
SECTION H/5

DETAILS OF 78" SEWER GATE CHAMBER

SCALE: 1/4"=1'-0"



PLAN

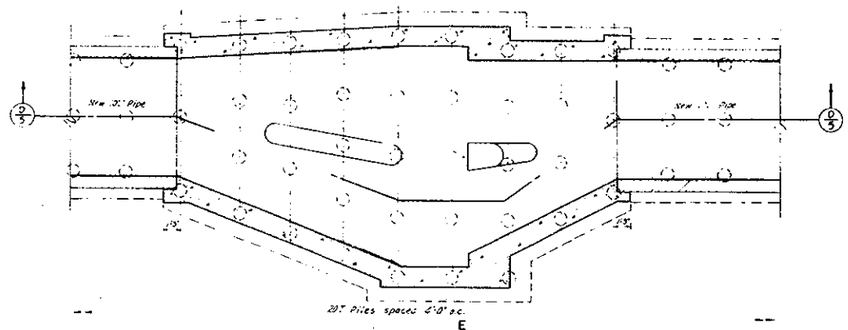


SECTION J/5

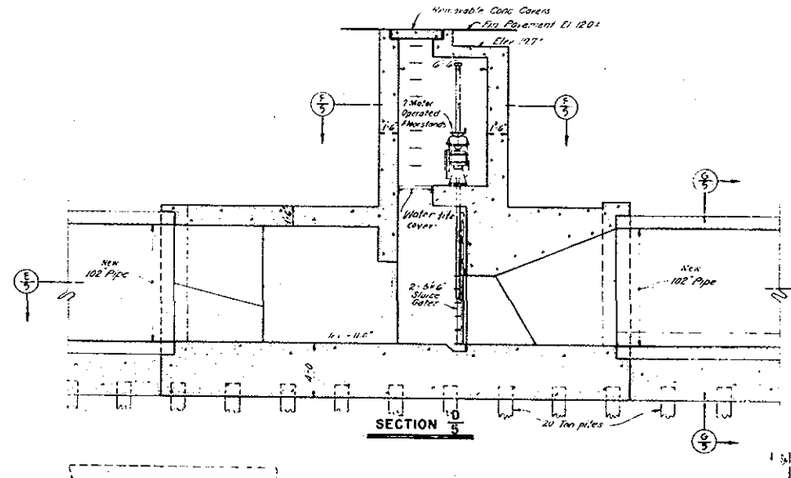
ELEVATION

DETAILS OF WATER METER PIT

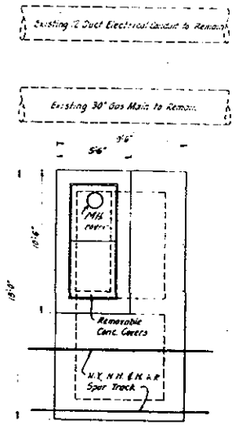
SCALE 1/4"=1'-0"



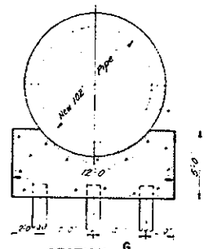
SECTION E/5



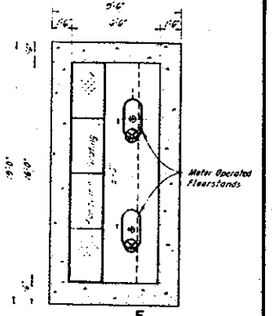
SECTION D/5



PLAN AT SURFACE



SECTION G/5



SECTION F/5

DETAILS OF 102" SEWER GATE CHAMBER

SCALE: 1/4"=1'-0"

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT — ENGINEERS
PROVIDENCE 2, R. I. BOSTON 24, MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

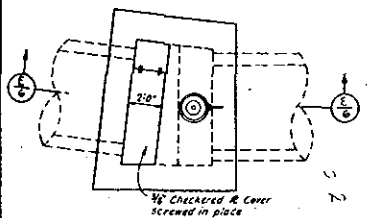
DRAWN BY: H.E.B.
TRACED BY: H.L. & B.G.
CHECKED BY: H.E.B. & H.K.
SUBMITTED:
APPROVED

FOX POINT HURRICANE BARRIER
ALLENS AVE. TRUNK SEWER
GATE CHAMBER DETAILS

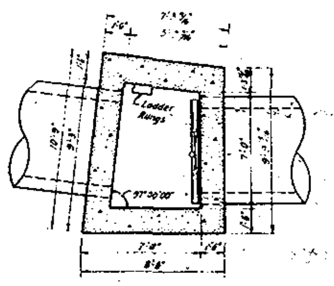
PROVIDENCE RHODE ISLAND
APPROVED DATE JAN. 1960

SCALE AS SHOWN SPEC. NO.
DRAWING NUMBER
SHEET 5 OF 10

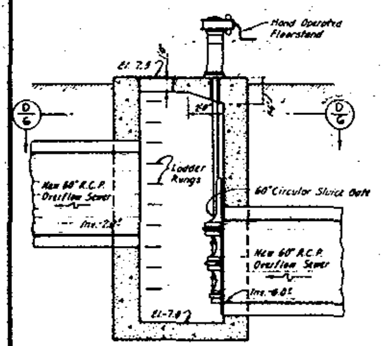
PLATE NO. 12-5



PLAN



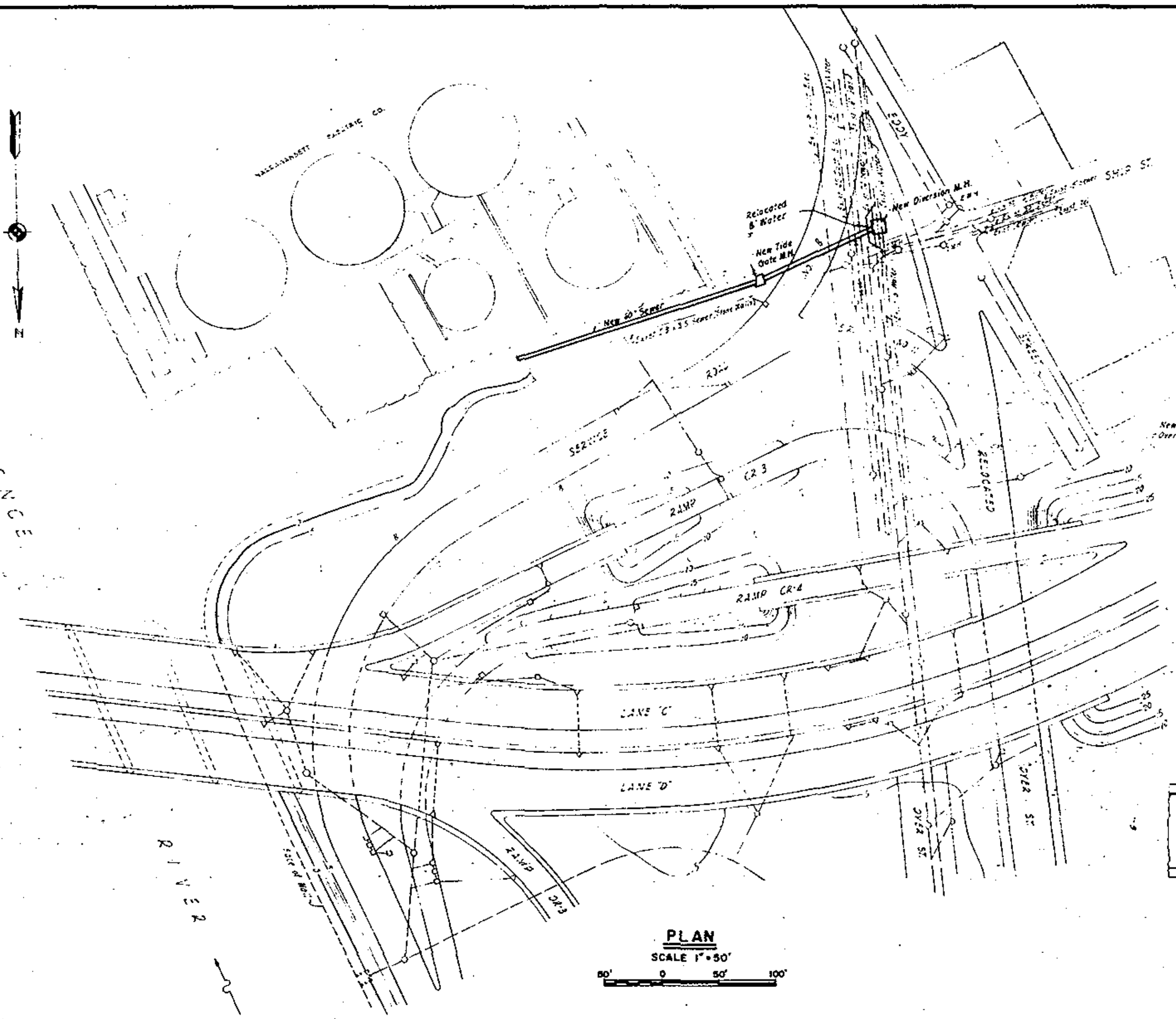
SECTION D/6



SECTION E/6

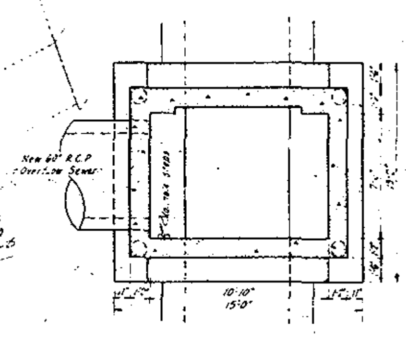
GATE CHAMBER

SCALE 1/4" = 1'-0"

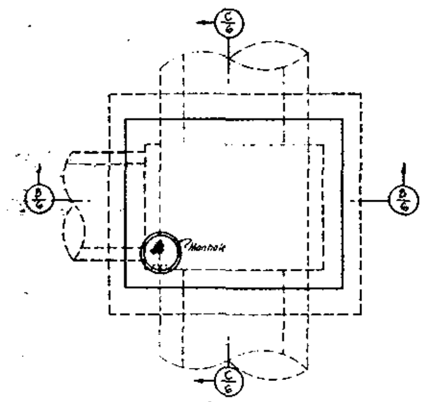


PLAN

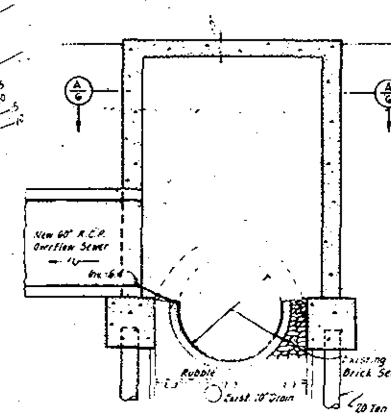
SCALE 1" = 50'



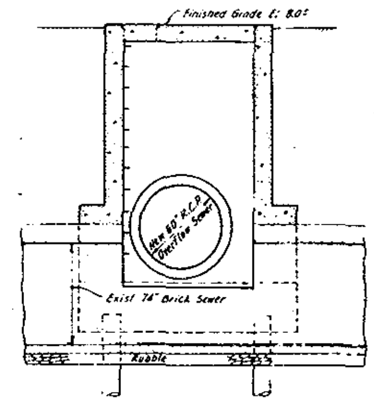
SECTION A/6



PLAN



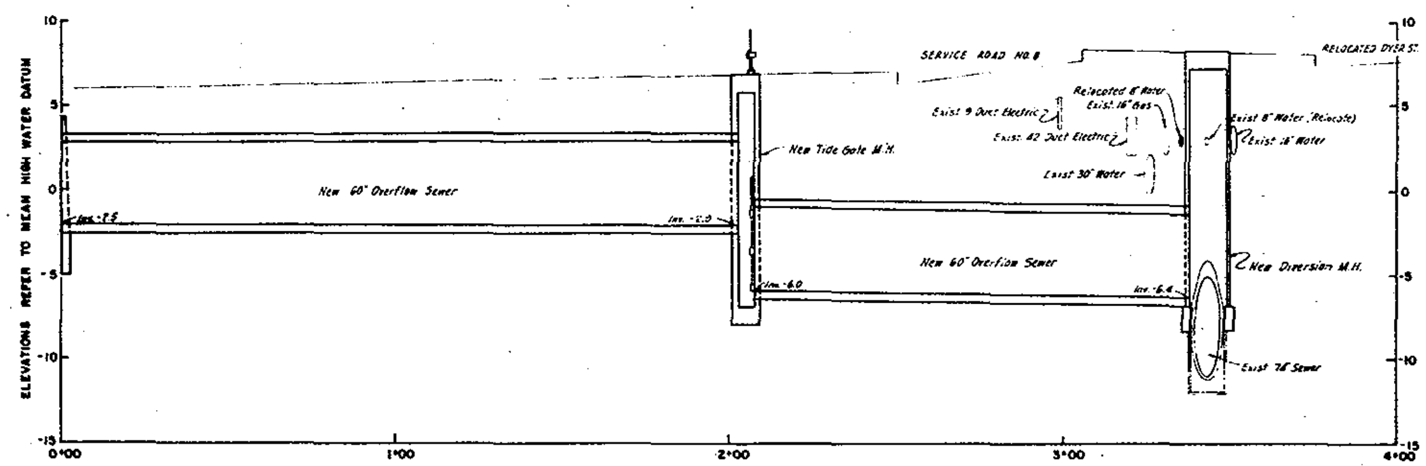
SECTION B/6



SECTION C/6

DIVERSION MANHOLE

SCALE 1/4" = 1'-0"



PROFILE ALONG ℄ NEW 60" OVERFLOW SEWER

SCALE: HOR. 1" = 20'
VERT. 1" = 4'

NOTE

Elevations shown on this sheet only, refer to Mean High Water Datum (Mean High Water 2.35 ft. above Mean Sea Level)

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING
ARCHITECT – ENGINEERS
PROVIDENCE 3, R. I. BOSTON 34, MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

DRAWN BY: H.E.B.
TRACED BY: B.G.
CHECKED BY: HFB & PC.
SUBMITTED:
APPROVED:

FOX POINT HURRICANE BARRIER

SHIP ST. OVERFLOW SEWER

PLAN AND PROFILE

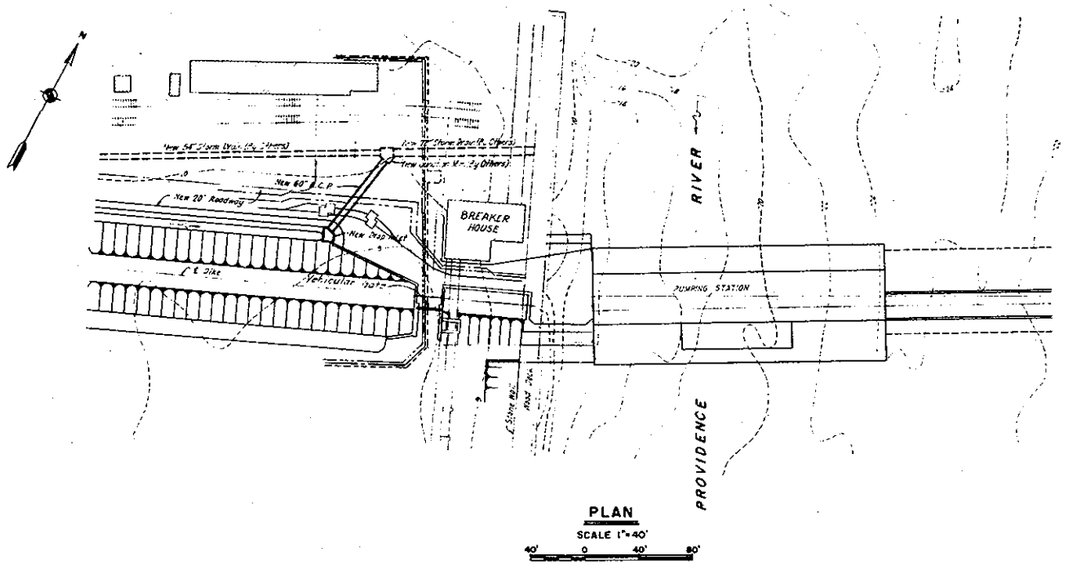
PROVIDENCE RHODE ISLAND

APPROVED:
DATE: JAN. 1960

SCALE AS SHOWN | SPEC. NO.
DRAWING NUMBER
SHEET 6 OF 10

CORPS OF ENGINEERS

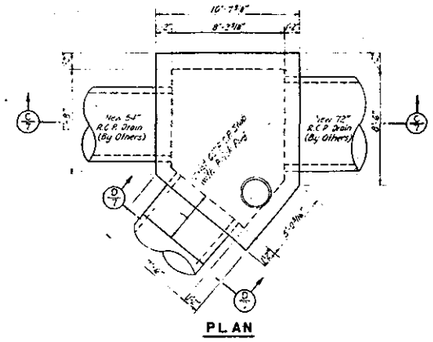
U. S. ARMY



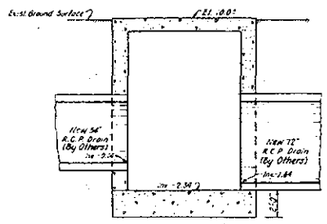
PLAN

SCALE 1"=40'

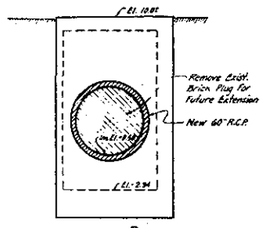
40' 0 40' 80'



PLAN



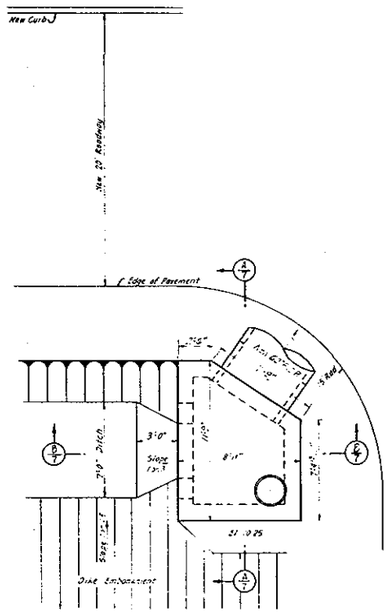
SECTION C/7



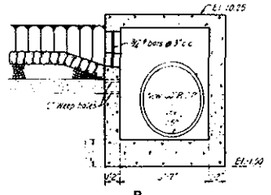
SECTION D/7

DETAILS OF NEW JUNCTION MANHOLE (By Others)

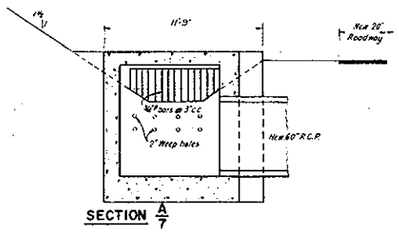
SCALE 1/4" = 1'-0"



PLAN



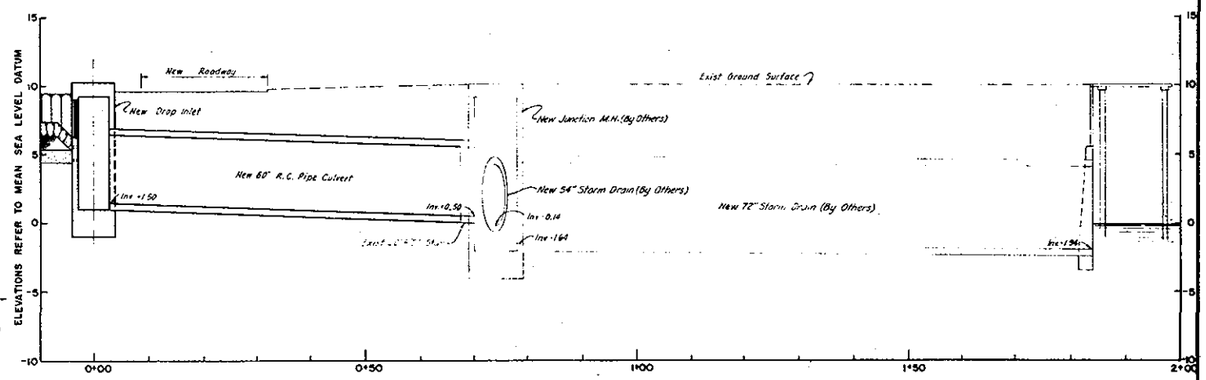
SECTION B/7



SECTION A/7

DETAILS OF NEW DROP INLET

SCALE 1/4" = 1'-0"



CULVERT PROFILE

SCALE HOR. 1"=10'
VERT. 1"=4'

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT – ENGINEERS
PROVIDENCE R. I. BOSTON 34, MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

DRAWN BY: H.E.B.
TRACED BY: B.G.
CHECKED BY: H.E.B. & P.C.
SUBMITTED:
APPROVED
CHIEF, ENGINEERING DIVISION

FOX POINT HURRICANE BARRIER
WEST ABUTMENT CULVERT
PLAN AND DETAILS

PROVIDENCE RHODE ISLAND

APPROVED DATE
CHIEF, U.S. ARMY ENGINEER DIVISION

JAN. 1960

SCALE AS SHOWN

SPEC. NO.

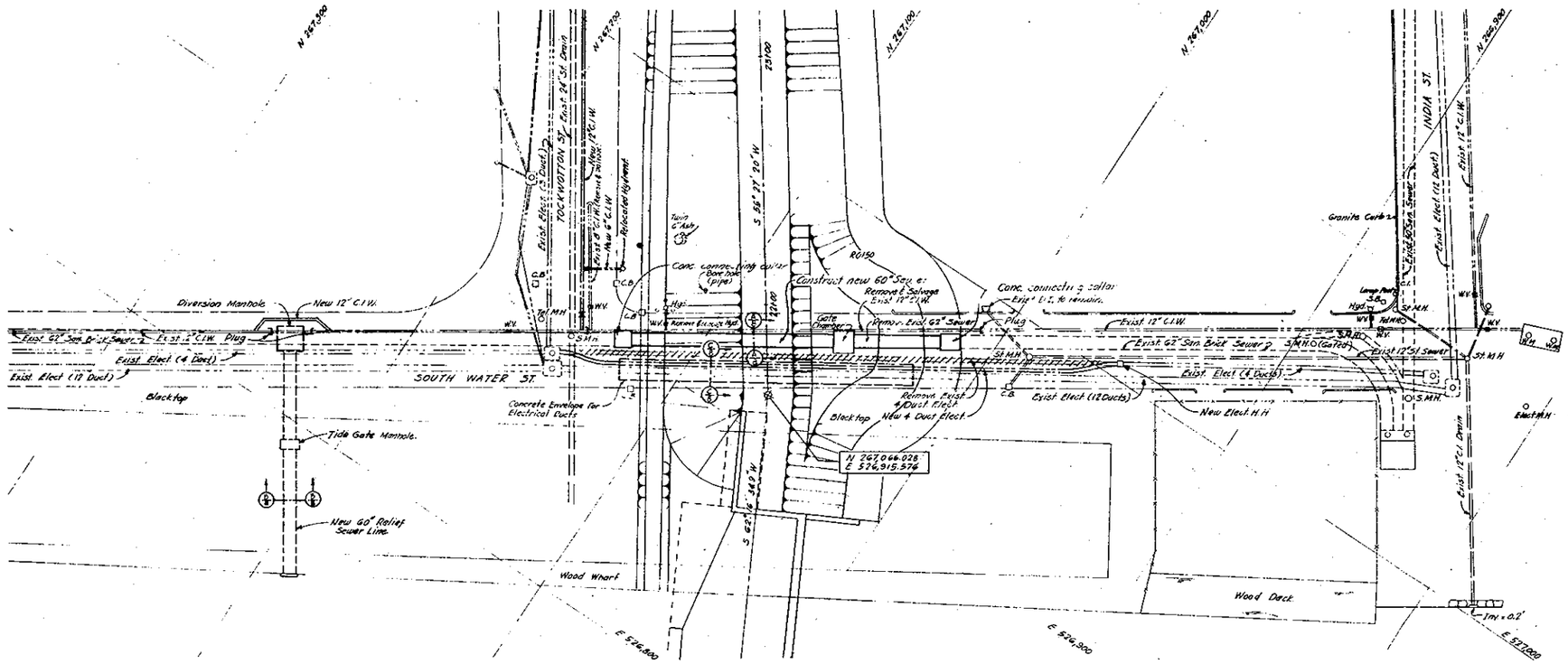
DRAWING NUMBER

SHEET 7 OF 10

PLATE NO. 12-7

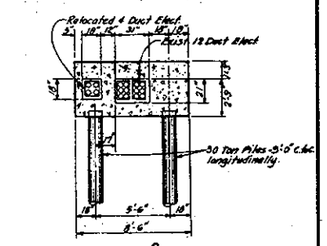
CORPS OF ENGINEERS

U. S. ARMY



PLAN

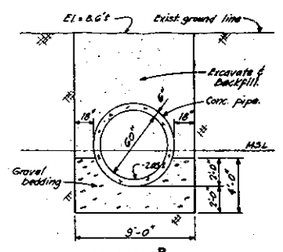
SCALE: 1" = 20'-0"



SECTION C/8

CONCRETE ENVELOPE

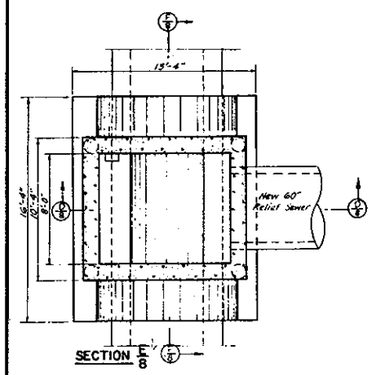
SCALE 1/2" = 1'-0"



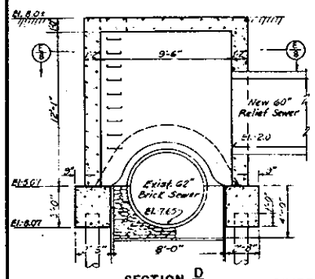
SECTION B/8

NEW 60" RELIEF SEWER LINE

SCALE 1/4" = 1'-0"



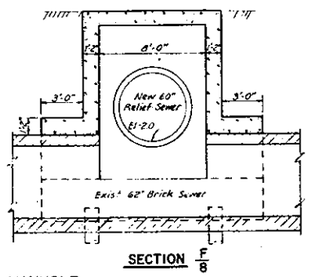
SECTION E/8



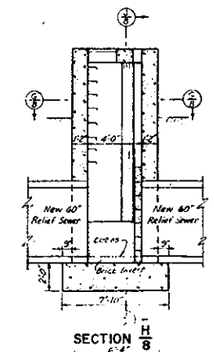
SECTION D/8

DIVERSION MANHOLE

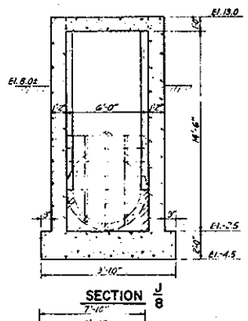
SCALE 1/4" = 1'-0"



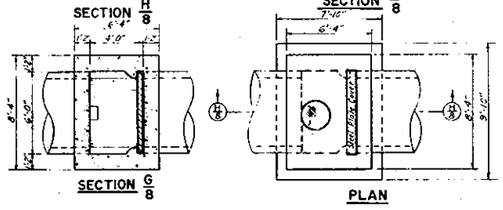
SECTION F/8



SECTION H/8



SECTION J/8

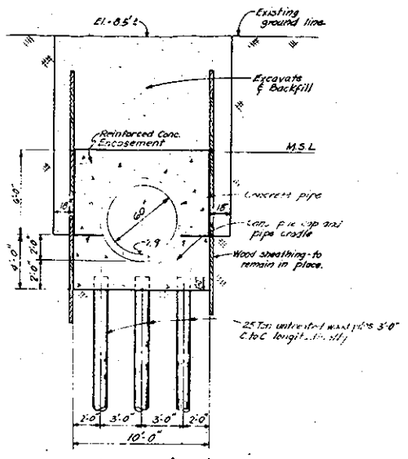


SECTION G/8

PLAN

TIDE GATE MANHOLE

SCALE 1/4" = 1'-0"



SECTION A/8

NEW 60" SEWER LINE

SCALE 1/4" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT – ENGINEERS
PROVIDENCE, R. I. BOSTON, MASS.

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASS.

DRAWN BY: H.E.B.
TRACED BY: P.C. & A.S.
CHECKED BY: H.E.B. & P.C.
SUBMITTED:
APPROVED

FOX POINT HURRICANE BARRIER

UTILITY MODIFICATIONS

SOUTH WATER STREET

PROVIDENCE RHODE ISLAND

APPROVED DATE

CHIEF, ENGINEERING DIVISION CHIEF, C.E. BR'CH DIVISION ENGINEER

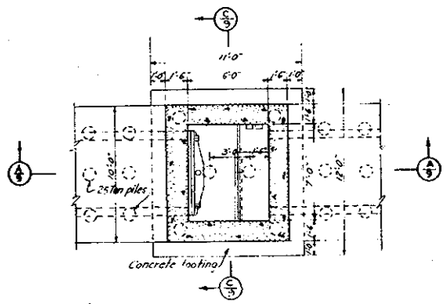
JAN. 1960

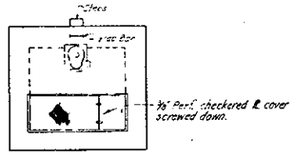
SCALE AS SHOWN SPEC. NO.

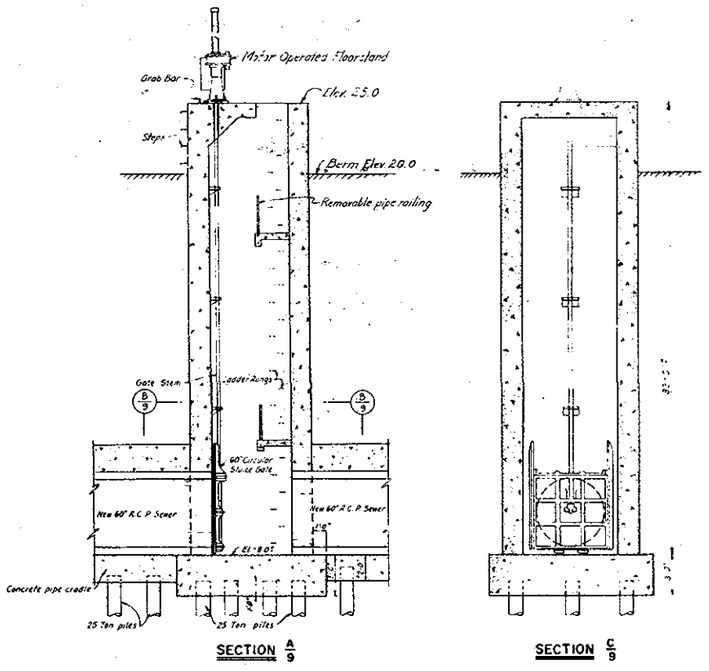
DRAWING NUMBER

SHEET 8 OF 10

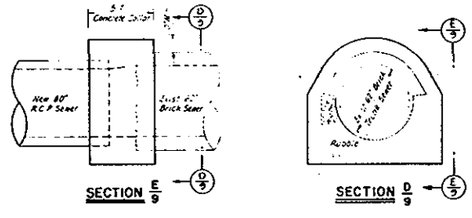
PLATE NO. 12-8



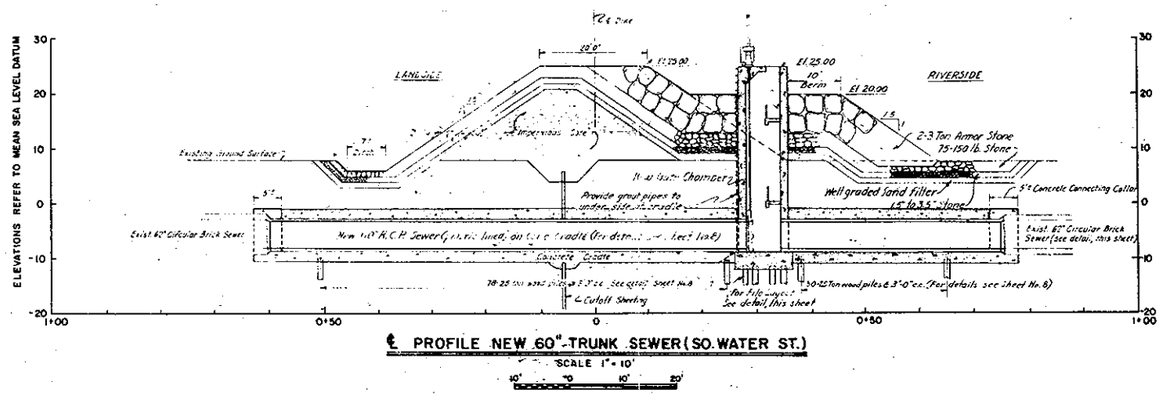




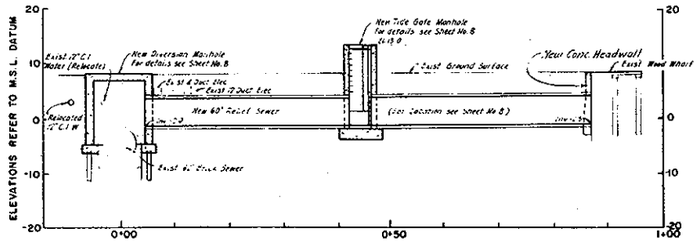
GATE CHAMBER
SCALE 1/4" = 1'-0"



CONNECTING COLLAR DETAILS
SCALE 1/4" = 1'-0"



℄ PROFILE NEW 60" TRUNK SEWER (SO. WATER ST.)
SCALE 1" = 10'



℄ PROFILE NEW 60" RELIEF SEWER
SCALE 1" = 10'

REVISION	DATE	DESCRIPTION	BY

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT - ENGINEERS
PROVIDENCE R. I. BOSTON MASS.

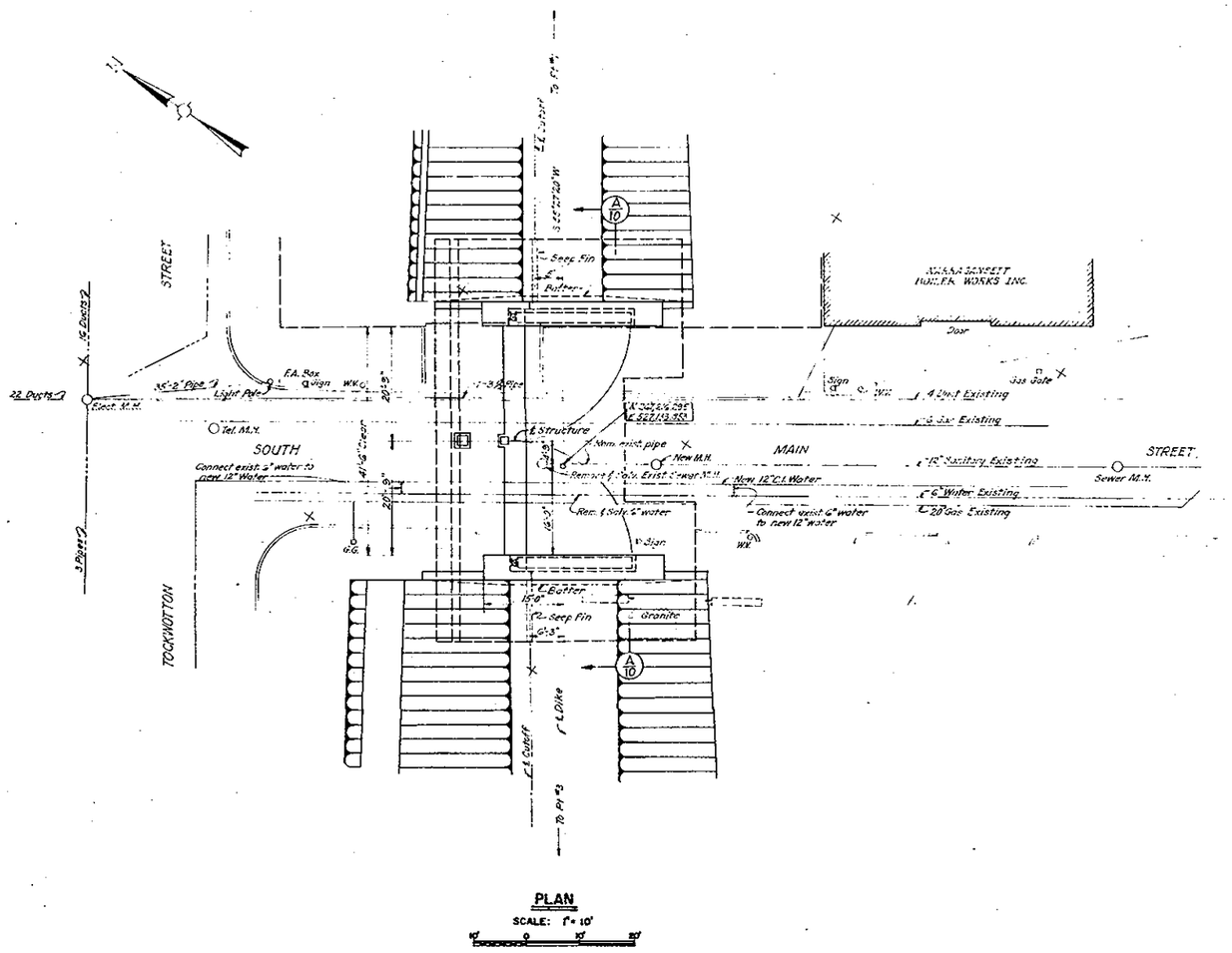
U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

DRAWN BY: H.L. B & P.C.
TRACED BY: B.G.
CHECKED BY: H.L. & P.C.
SUBMITTED:
APPROVED:

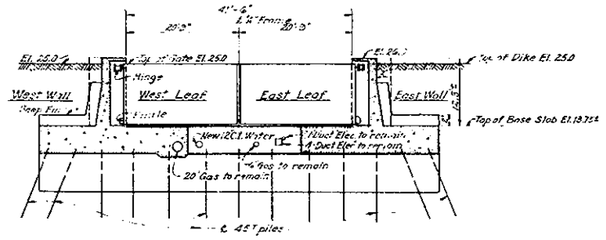
FOX POINT HURRICANE BARRIER
TRUNK AND RELIEF SEWERS
SOUTH WATER STREET
PROVIDENCE RHODE ISLAND

APPROVED: DATE
DATE 10-[illegible]
SCALE
SPEC. NO.
DRAWING NUMBER
SHEET 9 OF 10 SHEETS

PLATE NO. 12-9



PLAN
SCALE: 1" = 10'



ELEVATION A/10

REVISION	DATE	DESCRIPTION	BY
FENTON G. KEYES ASSOCIATES CONSULTING ARCHITECT – ENGINEERS PROVIDENCE R. I. & BOSTON MASS.		U. S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS 424 TRAPELO ROAD WALTHAM MASS.	
DRAWN BY: J. L.	FOX POINT HURRICANE BARRIER		
TRACED BY: R.H.P.	UTILITY MODIFICATIONS		
CHECKED BY: H.E.B. & P.C.	SOUTH MAIN STREET		
SUBMITTED:	PROVIDENCE	RHODE ISLAND	
APPROVED:	APPROVED	DATE	
CHIEF ENGINEERING DIVISION	CHIEF, ENGINEERING DIVISION		
	SCALE 1" = 10'	SHEET NO.	
	DRAWING NUMBER		
	SHEET 10 OF 10		

PLATE NO. 12-10